Jesus speaks Korean:
Christianity and literacy in colonial Korea

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Abstract

In the mid 19th century, pre-colonial Korea under the Joseon dynasty was increasingly isolated and lagging behind in its economic development. Joseon Korea was forced to sign unequal treaties with foreign powers as a result of which Christian missionaries entered the country and contributed to the establishment of private schools. We show that areas with a larger presence of Christians have higher literacy rates in 1930, during the Japanese colonial period. We also show that a higher number of Protestants is associated with higher female literacy, consistent with a stronger emphasis on female education in Protestant denominations.

Keywords: Literacy, Religion, Missionaries, Gender gap, Korea.

JEL Classification: I21; N35; Z12; J16.

1. Introduction

In modern economies, more educated people typically earn more (see Card 1999). The reason why education might have pecuniary payoffs is explained by human capital theory. The key idea is that education is an investment which yields higher labour-market earnings because it increases productivity (Becker 1967). There is a substantial body of work showing that human capital mattered for economic development, in different European countries, in different periods, even before modern times.[1] Similarly, a rapidly growing literature studies the role of missionaries for economic development around the world.[2] In East Asia, for instance, Bai and Kung (2015) find that Chinese regions that had higher penetration of Protestant missionaries during the 19th century also had higher urbanization rates at the beginning of the 20th century.[3] In South America, Valencia Caicedo (2019a) shows the persistent effect of Jesuit historic missions on education and income today. Given the role attributed to education in economic development, it is important to understand the historical roots of educational achievement.

We examine the roots of regional differences in literacy in colonial Korea, specifically in the year 1930. The roots of schooling accessible to broader parts of the population are largely the result of "globalization" in the form of Korea's opening up to the outside world in the late 19th century (see Cappelli and Mitch, 2019, for the role of "globalization" in the rise of mass education). A push towards education resulted both from the arrival of Christian missionaries during the late 19th century (McCleary, 2013) and from public schooling instituted during Japanese colonial times (Hong and Paik, 2018). Go and Park (2019) note that the rise of mass public schooling at the elementary level Korea was notable, compared with the experience of other colonies in Southeast Asia, South Asia and Africa (Chaudhary 2009; Frankema 2012, 2013; Chaudhary and Garg 2015). While school enrolment was far from universal even at the end of Japanese rule in 1945, the foundation was laid for a continued development in public education

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[1] Meisenzahl and Mokyr (2012) highlight the role of technical competence, as a key factor in Britain's economic leadership. Kelly, Mokyr and O'Grada (2014) point to the importance of human capital (broadly defined) and the quality of the British labor force on the eve of the Industrial Revolution. De Pleijt (2018) shows that, in England, human capital facilitated pre-industrial economic development. Squicciarini and Voigtlaender (2015) show that upper-tail human capital, proxied by the historical presence of knowledge elites mattered for industrialization in France. Cinnirella and Streb (2017) analyze the role of human capital and innovation in economic development, using Prussian data. Dittmar and Meisenzahl (2020) document that German cities that formalized public goods provision (Protestant church ordinances stipulating schooling) in the 1500s began to differentially produce and attract upper tail human capital and became significantly larger in the long-run.

[2] See Woodberry (2011) for an early survey on the literature on missionaries. The literature on missionaries and education is more extensively covered in recent surveys for Africa by Meier zu Selhausen (2019) and for Latin America and Asia by Valencia Caicedo (2019b).

[3] Even earlier, between 1580 and 1780, the Jesuits introduced Chinese literati to Western scientific thought (Ma, 2020).

in Korea after independence, and arguably contributed to the dramatic economic growth of (South) Korea after WWII.

While the role of Christian missionaries has been stressed before, we are not aware of a formal regression analysis that studies the relative role of Christian missionaries, compared to other actors in fostering schooling and literacy. Before 1884, Korea only had quite a small number of Christians. Virtually all of them were "crypto"-Catholics, going back to Jesuit missionaries in China whose books were read in Korea (Rausch, 2017). In pre-colonial Korea, under the Joseon dynasty, there were several waves of persecution of Catholics, in 1839 (Ki-hae persecution), 1846 (Pyong-o persecution) and 1866 (Pyong-in persecution). Overall, there were 10,000 martyrs. In 1866, only 20,000 Catholics were left. In 1884, Korea opened up to the outside world. As a result, Presbyterian and Methodist Episcopalian missionaries engaged in medical and educational work. Several Korean scholars have attributed to the mainline Protestant missions, particularly the Methodists, the country's modern curriculum and high literacy rates (Lee 1989; Park 2000).

However, there are few empirical studies of literacy rates in colonial Korea, Hong and Paik (2018) being the notable exception.[4] However, the focus of their work is on pre-colonial elites. More specifically, they investigate how the civil exam system and scholarly traditions in pre-colonial times interact with the provision of public schools under Japanese colonial rule, to influence levels of literacy in colonial Korea. Their key finding is that Korean literacy was higher during the early colonial period in areas where before colonization more people (elites) had passed the civil service exam. This result is explained by the role those elites played in establishing private schools as alternatives to the colonial public schools.

In this paper, we build on this earlier work, and add data on the presence of three groups of religious players: Christian priests, Buddhist monks and (Japanese) Shin-to priests. Our hypothesis is that Christian ministers made a positive contribution to Korean literacy, both through their role in running (private) missionary schools (Go and Park, 2019), but also via informal night gatherings and educational activities by Christians (Noh, 1975, and Han, 1997).[5] Buddhist monks and Shin-to priests, in contrast, were not involved in similar educational activities.

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[4] Go and Park (2019) compare public schooling in Taiwan and Korea, which were colonized by Japan in 1895 and 1905, respectively. Using aggregate data, they show that the Korean public schooling system developed more slowly, as a result of weaker school financing.

[5] Han (1997) mentions a total of 808 evening study groups (*yahak*) across Korea.

It is important to note that while, at the end of the 19th century, Western Christian missionaries were the starting point for broader Christianization efforts, in the sequel Koreans were ordained as priests. In 1932, there were 2,552 Christian priests across Korea, of whom 341 were Western missionaries from the U.S., the U.K., France, Germany, etc. (Chōsen Government-General, 1932). In other words, the vast majority of Christian ministers were locals.[6] Missionary work thus was a joint effort between Western ministers and locals.

The contribution of Protestant churches to literacy was not only through the regular day-time schools, but also through informal channels: Protestant churches provided night study groups and were also major providers of *Hangul Kansupso* (schools teaching Korean) such as "*sodang*" (which were originally traditional Confucian schools), and summer schools for children. These kinds of institutions were mainly operated by native Korean Christians. The curriculum of these institutions usually included reading and writing the Korean and Japanese languages, and basic mathematics. According to Han (1997), there were 17,544 night study groups in 1929, 11,375 *sodang* in 1932, and 952 summer schools for children in 1932 across the Korean peninsula, respectively. This extensive education activity of Christians supported an increase in literacy in Korean and Japanese.[7]

Buddhism was introduced to Korea from China at A.D 372.[8] However, the goal of the Joseon dynasty that ruled Korea before the colonial period, was to promote Confucianism and hence largely suppressed Buddhism. This explains why there was a low number of Buddhists in Korea in the colonial period despite a long history of Buddhism in Korea. After Japan annexed Korea, the Chōsen Government-General tried to reform Korean Buddhism into a system similar to Japanese Buddhism. In particular, the Chōsen Government-General issued the Temple Ordinance in 1911 to control Buddhism in Korea, by allowing the Japanese government to directly oversee the 30 main temples in Korea. (Sørensen, 1997) As a result, it is presumed that all Buddhist monks were Korean or Japanese during the colonial period.

As we will show, the vast majority of Koreans, in 1930, remained Confucian, so were neither Christian, nor Buddhist, nor believers of Shin-To (followers of the Japanese Shin-to faith). Confucianism is often characterized as a system of social and ethical philosophy rather than a

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[6] This is a development similar to the one stressed by Jedwab, Meier zu Selhausen, and Moradi (2019) for Africa, namely that locals constituted the vast majority of Christian ministers after the onset of missionary activities.

[7] Some of the early Western missionaries, e.g. John Ross and John McIntyre, two Scottish Presbyterian missionaries, commanded the Korean language and initiated the Korean translation of the Bible (Kim and Kim, 2015), but given the large number of Korean ministers, it was not essential for education to succeed.

[8] See http://afe.easia.columbia.edu/tps/300ce_ko.htm#buddhism (accessed 26 Sep 2020).

religion. Following this logic, statistics of the Chōsen Government-General only list Christians, Buddhists and Believers of Shin-To as followers of a religion.

Cheondoism was also a religious group at the time. Many believers of *Cheondoism* were involved in the independence movement in the Korean peninsula during the colonial period (Kim, 2016). But the Chōsen Government-General did not officially recognize *Cheondoism* as a religious group, which is why it is almost impossible to obtain reliable data regarding believers of *Cheondoism*. As a result, we focus on the three major religious groups described earlier, for which official statistics exist. Using data on the presence of ministers of these three faiths, as well as data on believers of those same faiths, we show a link between the number of Christians and (higher) literacy rates. While our focus is on literacy in the Korean language, we also consider literacy in Japanese and/or both languages.

We also look at literacy by gender, demonstrating that literacy rates are higher for both genders in areas with a larger number of Christian ministers (and believers). Using data on the share of Catholic and Protestant ministers at the province level, we can see whether literacy rates vary by gender depending on the share of Catholic and Protestant ministers. In line with patterns observed at the country-level in 1970 (see Becker and Woessmann, 2008), as well as at the county-level in 19th century Prussia (see Becker and Woessmann, 2008), areas with a larger share of Protestant ministers had higher literacy rates for females, i.e. there is more egalitarian educational achievement across genders in those areas.

We want to stress that we consider our analysis as explorative. We do not claim a causal link between Christianity and literacy, although we do attempt to control for a multitude of confounding factors. A causal analysis is left for future research that will further explore the location choice of Christian missionaries and the spread of Christianity in pre-colonial and colonial Korea.

The paper is organized as follows. The next section introduces our data, section 3 presents results and section 4 concludes.

2. Data

Most of the data we use is published at the level of the 234 counties of colonial Korea. Some data is only available at the level of 13 provinces, as pointed out below.

Our key outcome variable is literacy. The Japanese colonial census published by the "Chōsen" Government-General ("Chōsen": Japanese name of Korea) covers Korean and Japanese residents

and includes *county-level* data on the number of people literate in Korean, Japanese, both languages, and neither language in 1930. In our main specifications, we use the literacy rate in Korean (i.e. being literate either Korean alone or Korean & Japanese), as Hong and Paik (2018), but we also look at the literacy rate (a) in Korean only; (b) Japanese only and (c) in Japanese (either Japanese alone or Korean & Japanese). Furthermore, the census provides literacy status by gender.

Given our interest in the role played by Christian ministers and clergy of other religions, we collect *county-level* data from the 1930 census taken by the Chōsen Government-General. The census classifies occupations in 1930 into 337 groups, among which are three major religious occupations: Christian priests, Buddhist monks, and Japanese Shin-to "Japanese Shin-To priests", the latter mostly serving Japanese immigrants ("colonizers").

Moreover, "*the Report on Religion in Korea*" (*Chōsen Government-General, 1932*) provides *province-level* data on the number of believers of the three major religious groups. Assuming that the number of believers per clergyman is the same across counties within the same province, we can obtain the total number of believers of religion r at the level of county c as follows:

$$\frac{\#\ clergy\ of\ religion\ r\ in\ county\ c}{\#\ clergy\ of\ religion\ r\ in\ province\ p} \times \#\ believers\ of\ religion\ r\ in\ province\ p$$

Based on the number of believers of religion r, we can compute their population shares.

The "*Report on Religion in Korea*" also provides the number of priests by Christian *denomination* at the *province level*. Using the number of Catholic and Protestant priests at the province level, we impute the number of Catholic and Protestant priests at the *county level*, assuming that their ratio across counties within the same province is identical.

We collect data on elementary schools and teachers for public, private and mission schools at the *province level* in 1930, from the *"Statistical Yearbook of the Chōsen Government-General"* (hereafter "Yearbook"). The Yearbook was published annually during the colonial period in Korea. Given that county-level literacy data are available only for 1930, we exploit the yearbook of 1930 to verify the relationship between schools and literacy rates.

We also employ data kindly shared by Hong and Paik (2018) on those passing civil service exams under the pre-colonial Joseon dynasty from their historical court examination archives. Their data not only covers the number of exam passers, but we also exploit control variables they used such as the percentage of the workforce in non-agricultural occupations, the land tenancy ratio, soil acidity, distance to Seoul and population density.

Furthermore, we use data on market size during colonial period, kindly shared by Park (2020), as well.[9] This data contains the volume of market transactions at the town level in 1928,[10] denominated in Japanese Yen. We aggregate town level to the county level. Market size is a proxy for the development of a local market economy.

We start with descriptive statistics. Table 1 shows that literacy rates were low in 1930 by Western standards at the time. About 22 percent of the population were literate in Korean, which comprises 15.2% who were literate in Korean only and 6.7% who were literate in both Korean and Japanese. 8.5% were literate in Japanese, which comprises 1.7% who were literate in Japanese only and the same 6.7% who were literate in both languages. Also notice the substantial variation across counties in literacy. For instance, the literacy rate in Korean varies between 11.6 and 43.7 percent across counties. Note that the literacy rate is computed relative to the whole population. If we had data on age composition in the 1930 census, we could compute it relative to a population of those above a certain age and would mechanically find a higher literacy rate. With this adjustment in mind, the Korean literacy rates seems to roughly compare with those in Italy *70 years earlier*. The (adult) literacy rate in Italy at the time of unification in 1861 was 27% and around 35% in 1871. The literacy rate in Spain was around 30% by 1870 (Cipolla, 1969).[11] For comparison, already in 1871, average literacy rates for those aged 10 and above, even in rural manors (the smallest administrative units with an average size of 126 people) in Prussia were 73% (Becker and Cinnirella, 2020).

Turning to religion variables, we measure the presence of Christian priests, Buddhist monks and Japanese Shin-To priests per 1,000 inhabitants. While some counties have no presence of either Christian, Buddhist or Japanese Shin-To priests, others have a substantial number per 1,000 inhabitants. For instance, *Wonsan* county has 1.684 Christian priests per 1,000 inhabitants,[12] *Yangsan* county has 5.755 Buddhist monks,[13] and *Suncheon* county has 1.5 Japanese Shin-To priests,[14] with the averages across all counties being 0.1 (Christian), 0.35 (Buddhist) and 0.034 (Japanese Shin-To priests) per 1,000 inhabitants, on average, across Korean counties.

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[9] We thank a referee for suggesting the use of this data.

[10] For instance, in the county of GoYang-Gun, there are 12 towns, only one of which (Jung-Myeon) has a physical market place whose transaction volume is captured in the data.

[11] Ciccarelli and Weisdorf (2019) provide regional literacy rates by gender for Italy during the 19th century.

[12] Wonsan is known for its many Christian monasteries and churches.

[13] Yangsan has a long history in Buddhism, featuring Tongdo Temple, one of the largest temples in Korea. Since Buddhist temps are usually located in mountainous areas and deep valleys, the number of Buddhist monks tends to be higher in rural areas.

[14] Suncheon is at the Southern tip of South Korea, across from Japan.

Noticeably, Korea being strongly Confucian from pre-colonial times, the share of believers in Christianity, Buddhism and Shin-to was low. On average, 2.75% were Christians, 2.56% were Buddhists, and 0.13% were believers of Shin-To. *Daegu* has an imputed share of Christians of 21.5% in the total population, *Yangsan* has an imputed share of 11.6% who are Buddhist, and *Kyungsung* county (the county comprising *Seoul)* has 8.6% who are believers of Shin-To. Remember that, since the number of believers is only available at the province-level, we assume a uniform distribution of believers per priest across counties in the same province, an assumption we cannot test and which may amplify some numbers. It is for this reason that we focus on the number of priests (measured at the county-level to begin with) in most of our tables, and only show results using the (imputed) share of believers in one regression table (Table 3). To further probe robustness of the use of the share of believers, Appendix Table A.2 uses the actual *province-level* share of believers across different groups instead of the (imputed) county-level ones. As Table 1 shows, using province-level data on the share of Christians, Buddhists and believers of Shin-To, we find average values of 1.79 (max 4.30%) for Christians, 0.49% (max 1.56%) for Buddhists and 0.34% (max 1.81%) for believers of Shin-To. Regression results are very similar when using province-level variables, alleviating worries that high imputed values might drive the results in Table 3.

Furthermore, we use *province-level* data on the number of public, (non-Christian) private schools, and missionary schools when trying to understand whether presence of Christian ministers (missionaries *and* local Korean priests) mainly affect literacy via the presence of missionary schools, or whether even controlling for the presence of schools of different types, literacy is affected, as suggested by the existence of night study groups that were far more numerous than missionary schools.

Finally, we use a rich set of additional variables. A key variable is the number civil exam passers (per 1,000 inhabitants), which is the focus of the analysis in Hong and Paik (2018). This variable captures the influence played by local elites in supporting education efforts during the colonial period. We will show that, throughout, this variable is an important predictor of literacy, thus confirming Hong and Paik (2018), while at the same time pointing to an additional effect of the presence of Christian ministers in fostering education. Additional control variables from Hong and Paik (2018) are the population share of Yangban (the upper social class) in 1909, as well as the percentage employed in non-agricultural occupations and population density to measure economic development, distance to Seoul, the capital of colonial Korea, the land tenancy ratio,

which Hong and Paik (2018) expect to positively influence the literacy rate because of its relationship with past achievements in civil exam examinations. Finally, soil quality is proxied by soil acidity, as soil quality is correlated with the population share of the elite (Hong and Paik, 2018). We use the same set of control variables not as a matter of convenience, but to ensure that we replicate important earlier research before complementing it with our analysis on the role of religion. Following the suggestion of a referee, we only go beyond the set of controls in Hong and Paik (2018) in one respect. We use market size per capita from Park (2020) to measure the development of a local market economy. Yet, in Table A.1, we show that, when using exclusively the Hong and Paik (2018) variables, we replicate their results.
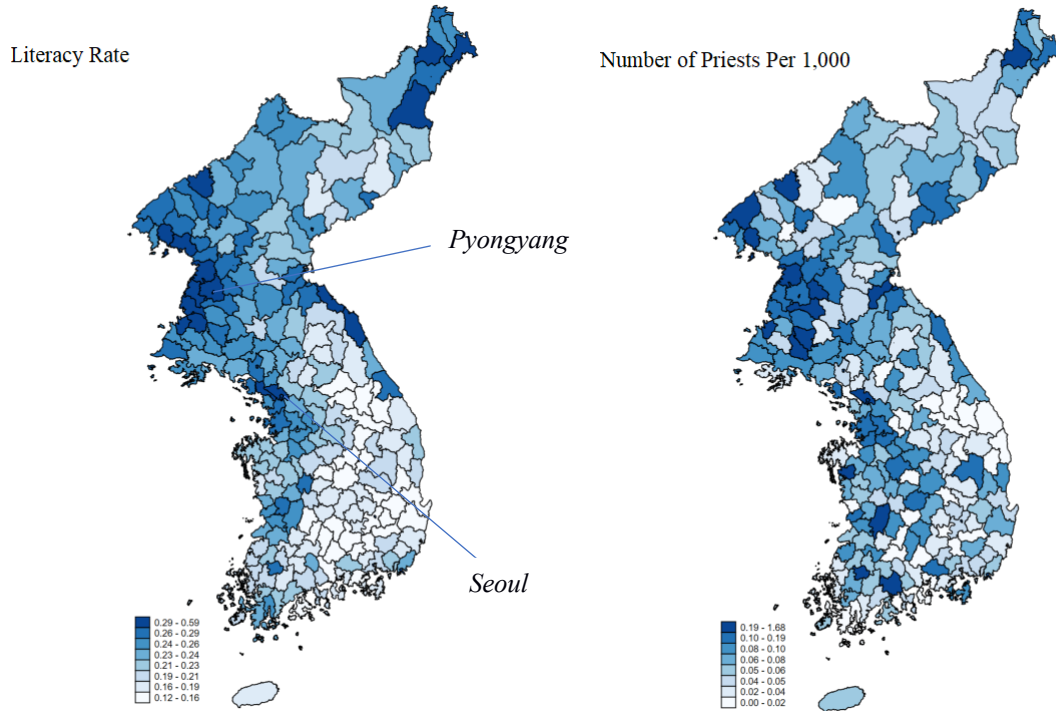
[Table 1] Descriptive Statistics

Category	Variable	Obs.	Mean	Std. dev.	Min	Max
Literacy	Korean Literacy Rate (Both + Only Korean)	234	21.921	5.184	11.618	43.744
	Japanese Literacy Rate (Both + Only Japanese)	234	8.461	7.025	2.830	43.755
	Koran Literacy Rate (Only Korean)	234	15.208	3.441	6.149	24.681
	Japanese Literacy Rate (Only Japanese)	234	1.748	3.973	0.101	25.607
	Korean and Japanese Literacy Rate (Both)	234	6.713	3.517	2.677	24.928
Religion	No. of Priests (Christianity) per 1,000	234	0.108	0.181	0.000	1.684
	No. of Monks (Buddhism) per 1,000	234	0.347	0.515	0.000	5.755
	No. of Japanese Shin-To Priests per 1,000	234	0.034	0.132	0.000	1.510
	Share of Christians	234	1.682	2.415	0.000	21.480
	Share of Buddhists	234	0.540	1.009	0.000	11.650
	Share of Shin-To believers	234	0.307	1.095	0.000	8.503
	Share of Christians [Province]	13	1.793	1.124	0.704	4.305
	Share of Buddhists [Province]	13	0.491	0.470	0.043	1.561
	Share of Shin-To believers [Province]	13	0.341	0.491	0.002	1.805
School	No. of Public Schools per 1,000 [Province]	13	0.082	0.013	0.056	0.099
	No. of Private Schools per 1,000 [Province]	13	0.014	0.018	0.000	0.065
	No. of Missionary Schools in per 1,000 [Province]	13	0.010	0.012	0.002	0.050
Controls	No. of Passer (Civil Exam) per 1,000	232	0.222	0.691	0.000	10.097
	Yangban (upper social class) share (1909)	223	0.007	0.013	0.000	0.098
	Non-Agricultural Occupation (%)	234	6.558	5.916	1.504	34.604
	Population density (1,000 people/km^2)	232	0.554	0.596	0.037	5.070
	Market Size per Capita (Japanese Yen)	220	7889.8	8964.8	82.284	82022
	Log Market Size	220	19.947	1.030	15.229	22.617
	Distance to Seoul (km)	233	223.12	122.66	0.000	642.63
	Land tenancy ratio	228	1.099	0.898	0.012	7.808
	Soil acidity	211	2.091	0.752	1.000	5.000

Note: Variables refer to 1930, unless otherwise noted. Variables are measured at the county level unless otherwise noted.
Source: Variables in Literacy rate and Religions are based on *the Census in Chōsen in 1930*. Variables is schools are from the *Statistical Yearbook of the Chōsen Government-General in 1930*. Controls variables are from Hong and Paik (2018) and Park (2020).

[Figure 1] Literacy in Korean and the Number of Christian priests in 1930

Literacy Rate

Number of Priests Per 1,000

Pyongyang

Seoul

| 0.29 - 0.59 |
| 0.26 - 0.29 |
| 0.24 - 0.26 |
| 0.23 - 0.24 |
| 0.21 - 0.23 |
| 0.19 - 0.21 |
| 0.16 - 0.19 |
| 0.12 - 0.16 |

| 0.19 - 1.68 |
| 0.10 - 0.19 |
| 0.08 - 0.10 |
| 0.06 - 0.08 |
| 0.05 - 0.06 |
| 0.04 - 0.05 |
| 0.02 - 0.04 |
| 0.00 - 0.02 |

Map source: Historical shape file created by Dr Jonghyuk Kim, who kindly shared it with us.
Data source: The Census in Chōsen in 1930.

[Figure 2] Number of missionary schools [province level].

Pyongyang

Seoul

| 0.049 - 0.056 |
| 0.042 - 0.049 |
| 0.035 - 0.042 |
| 0.028 - 0.035 |
| 0.014 - 0.028 |
| 0.009 - 0.014 |
| 0.000 - 0.009 |

Map source: Historical shape file created by Dr Jonghyuk Kim, who kindly shared it with us.
Data source: Statistical Yearbook of the Chōsen Government-General in 1930.

Figures 1 and 2 show the geographic distribution of some of our key variables of interest. Figure 1 shows that the North not only had higher literacy rates than the South, but also the North had a larger number of Christian priests.

Figure 2 shows the distribution of Christian missionary schools which is only available at the province-level, which explains why all counties in the same province share the same colour. The share of missionary schools is highest in the province around Pyongyang. It is also elevated in the province around Seoul, and overall higher in North Korea than in South Korea.

3. Regression Results

In order to analyse the link between of Christianity and literacy rates in Korea, we present ordinary least squares estimates of the following form at the *county level*:

$$LiteracyRate_i = a + \beta_1 ChristianPriest_i + X_i +$$

$$\beta_2 PublicSchool_j + \beta_3 PrivateSchool_j + \beta_4 MissionarySchool_j + \varepsilon_i$$

In this equation, i indexes one of the 234 counties and j one of the 13 provinces in Korea, respectively. $LiteracyRate_i$ is the share of inhabitants who can read and write Korean, in the year 1930. $ChristianPriest_i$ is the number of Christian priests per 1,000 inhabitants in each county. Since the literacy rate is likely to be affected by the number of schools, we consider the number of schools by types at the province level. $PublicSchool_j$, $PrivateSchool_j$, and $MissionarySchool_j$ are the number of schools by types at the *province level*. X_i is a set of controls which includes the number of clergy in the other major religions: Buddhist monks and Japanese Shin-to priests. Hong and Paik (2018) focus on the relationship between pre-colonial educated elites and levels of literacy in 1930. To verify the relationship, they use the number of civil exam passer from the (pre-colonial) Joseon Dynasty. We not only control for the number of civil exam passers, but we also include the variables which are considered as control variables by them for consistency, and to build on their pathbreaking work.

Table 2 shows the effect of the number of Christian priests per 1,000 inhabitants on literacy rates. Column 1 shows that counties with one more Christian priest per 1,000 inhabitants have a Korean literacy rate that is higher by 15.64 percentage points, 15.64 more literate people per 100 inhabitants, or 156.4 per 1,000 inhabitants. When we include all control variables, there is no considerable change in the size of the effect, and the effect of Christian priests per 1,000 remains statistically significant at the 5% confidence level. Interestingly, column 5 and 6 in Table 2 show

that public schools have no effect on the literacy rate, conditional on the other variables.[15] On the other hand, column 5 in Table 2 shows that the number of missionary schools has a significant impact. However, the effect disappears when we include province fixed effect in our model. This is not too surprising as the number schools is only measured at province level. Still, the result suggests that the presence of Christian priests has an effect on literacy above and beyond the presence of different types of schools.

[Table 2] The Number of Priests and Literacy Rate

Variable	(1)	(2)	(3)	(4)	(5)	(6)
Priests (Christianity) per 1k	15.641***	16.100***	21.444***	10.833***	14.375**	10.833**
	(3.936)	(4.479)	(7.347)	(3.376)	(5.498)	(4.377)
Monks (Buddhism) per 1k		-0.906*	-0.610	0.439	-0.295	0.439
		(0.479)	(0.510)	(0.428)	(0.480)	(0.394)
Japanese Shin-To Priests per 1k		-1.405	-3.872***	-1.993*	-2.180	-1.993*
		(2.670)	(1.022)	(1.025)	(1.428)	(1.108)
Passer (Civil Exam) per 1k			2.837**	2.211**	1.580	2.211**
			(1.382)	(0.947)	(1.378)	(0.790)
Public Schools per 1k [Province]					-16.538	10.120
					(79.917)	(67.186)
Private Schools per 1k [Province]					68.474	365.019*
					(39.530)	(180.683)
Missionary Schools in per 1k [Province]					135.100**	-47.314
					(51.887)	(85.006)
Control Variables	NO	NO	YES	YES	YES	YES
Province Fixed Effect	NO	NO	NO	YES	NO	YES
Observations	234	234	199	199	199	199
R-squared	0.252	0.391	0.587	0.687	0.624	0.687
Mean of dependent variable	21.92	21.92	21.10	21.10	21.10	21.10

Notes: Robust standard errors (columns 1-4) and standard errors clustered by province (columns 5-6) in parentheses:
*** p<0.01, ** p<0.05, * p<0.1
Control variables are the *Yangban* (upper social class) share in 1909, Non-Agricultural Occupation (%), Population density (1,000 people/km^2), Distance to Seoul (km), mean of Soil acidity and its square, and variance of Soil acidity, which are identical to the controls used by Hong and Paik (2018). Market size per capita is included as control variable which was used by Park (2020).

Our subsequent analysis replaces the number of Christian, Buddhist and Shin-to clergy with the share of believers of the same faiths. The OLS equation is identical to equation (1), but we replace the *Priest* variables with a variable representing the number of believers.

Table 3, which is organized in the same way as Table 2, shows the relationship between the share of Christians and the literacy rate in the Korean language. The range of coefficient estimates

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[15] Note that, whenever we have province-level variables on the right-hand side, or when we use variables that have been generated using province-level multiplying factors in later tables, we cluster standard errors at the province level.

for the share of Christian believers is between 0.50 and 0.97 depending on the specification, and the positive effect remains statistically significant at the 1 per cent level in all specification.

[Table 3] Literacy Rate and the Number of Believers of Different faiths

Variable	(1)	(2)	(3)	(4)	(5)	(6)
Share of Christians [1932]	1.247***	1.148***	1.376***	0.778***	1.125***	0.778***
	(0.203)	(0.251)	(0.237)	(0.205)	(0.225)	(0.205)
Share of Buddhists [1932]		-0.993*	-0.728*	0.043	-0.554*	0.043
		(0.457)	(0.384)	(0.096)	(0.268)	(0.096)
Share of Believer of Shin-To [1932]		0.440	-0.006	0.280	-0.019	0.280
		(0.401)	(0.763)	(0.552)	(0.644)	(0.552)
Passer (Civil Exam) per 1k			3.195**	2.321**	2.023	2.321**
			(1.440)	(0.872)	(1.137)	(0.872)
Public Schools per 1k [Province]					18.029	-7.709
					(64.111)	(62.497)
Private Schools per 1k [Province]					100.035***	250.277
					(31.301)	(180.158)
Missionary Schools in per 1k [Province]					102.049**	8.698
					(45.658)	(86.324)
Control Variables	NO	NO	YES	YES	YES	YES
Province Fixed Effect	NO	NO	NO	YES	NO	YES
Observations	234	234	199	199	199	199
R-squared	0.337	0.378	0.430	0.721	0.577	0.721
Mean of dependent variable	21.92	21.92	21.10	21.10	21.10	21.10

Standard errors clustered by province in parentheses: *** p<0.01, ** p<0.05, * p<0.1
Control variables are the *Yangban* (upper social class) share in 1909, Non-Agricultural Occupation (%), Population density (1,000 people/km^2), Distance to Seoul (km), mean of Soil acidity and its square, and variance of Soil acidity, which are identical to the controls used by Hong and Paik (2018). Market size per capita is included as a control variable used by Park (2020).

Finally, we turn to an analysis of two specific dimensions of heterogeneity: first, on the right-hand side, we sub-divide Christianity into Protestants, Catholics, and other Christians (e.g. Orthodox); second, we use gender-specific literacy rates. According to Becker and Woessmann (2008), a larger share of Protestants tends to decrease the (typically male-biased) gender gap in education. To examine whether this is also the case in Korea, we construct, as mentioned in the Data section, the number of Protestant and Catholic priests at the county level by using the ratio of Protestant and Catholic priest at the *province level*.

Table 4 shows the results. The literacy rate in Korean, by gender, was 34.9 percent for males and 7.1 percent for females, respectively. According to columns 4 to 6, the number of Catholic priests has a positive effect on the literacy rate of males, while it has a negative effect on the literacy rate of females. However, estimations are statistically insignificant.

On the other hand, the number of Protestant priests per 1,000 inhabitants has a positive effect on the literacy rate of females. Furthermore, the number of private schools per 1,000 inhabitants

has a positive effect on the literacy rate of males. On the other hand, none of the school variables has an impact on the literacy rate of females. This result suggests that the improvement of male's literacy rate comes through formal schooling, while the female literacy may benefit also from informal schooling (e.g. night study groups).

[Table 4] Literacy by gender and by Christian denomination (Catholic vs Protestant)

	All	*Male*	*Female*	*All*	*Male*	*Female*
Variable	(1)	(2)	(3)	(4)	(5)	(6)
Priests (Christianity) per 1k	10.993**	9.976*	11.927**			
	(4.591)	(4.924)	(4.844)			
Catholic Priests per 1k				126.427	387.192	-153.955
				(219.361)	(313.169)	(133.580)
Protestantism Priests per 1k				2.434	-17.992	24.226**
				(15.626)	(23.013)	(8.661)
Monks (Buddhism) per 1k	2.213**	2.406	2.482***	2.108**	2.064	2.632***
	(0.796)	(1.644)	(0.478)	(0.895)	(1.725)	(0.496)
Japanese Shin-To Priests per 1k	0.416	0.613	0.158	0.380	0.496	0.209
	(0.399)	(0.668)	(0.130)	(0.344)	(0.542)	(0.141)
Passer (Civil Exam) per 1k	-1.912*	-1.794	-2.303**	-1.604	-0.791	-2.745***
	(1.031)	(1.129)	(0.859)	(1.102)	(1.258)	(0.790)
Public Schools per 1k	19.680	149.245	-69.247	99.340	409.561*	-183.722*
	(68.726)	(107.618)	(60.734)	(157.454)	(225.820)	(94.925)
Private Schools per 1k	391.585*	1,071.738***	-243.541	547.344	1,580.728***	-467.371**
	(180.718)	(295.452)	(150.449)	(310.450)	(427.781)	(205.189)
Missionary Schools in per 1k	-55.441	-216.858	100.149	-146.866	-515.618*	231.530*
	(83.762)	(134.936)	(70.534)	(175.474)	(242.463)	(116.330)
Control Variables	YES	YES	YES	YES	YES	YES
Province Fixed Effect	YES	YES	YES	YES	YES	YES
Observations	199	199	199	199	199	199
R-squared	0.716	0.800	0.609	0.717	0.806	0.617
Mean of dependent variable	21.10	34.68	6.922	21.10	34.68	6.922

Standard errors clustered by province in parentheses *** p<0.01, ** p<0.05, * p<0.1
Control variables are the *Yangban* (upper social class) share in 1909, Non-Agricultural Occupation (%), Population density (1,000 people/km²), Distance to Seoul (km), mean of Soil acidity and its square, and variance of Soil acidity, which are identical to the controls used by Hong and Paik (2018). Market size per capita is included as a control variable used by Park (2020).

4. Conclusions

Our findings can be summarized in three parts. First, the larger the presence of Christian priests in a county, the more people can write and read Korean or Japanese. Second, this effect is not just the result of more formal schooling as measured by the presence of missionary or other private schools. Many studies related to mass education and human capital during the colonial period in Korea attribute higher literacy to the introduction of public education institutions by the

Japanese (Kimura 1993; Cha 2014). However, our findings are that the number of public schools did not contribute to the improvement of literacy rate in a statistically significant way. While we do find some evidence of a positive effect of private schools and missionary schools in some specifications. According to Go & Park (2019), there were two take-off periods in enrolment rates, one in the early 1920s and another in the mid-1930s. However, our finding shows that there was no strong effect of the first take-off in mass education in the 1920s, while we cannot address the effect of the second take-off in enrolment in mid-1930s due to lack of data.

the most striking finding is that the presence of Christian priests per se remains significant across all our analyses. The reason that However, the answer to why the presence of priest increases literacy rate remains a mystery because the main task of a priest in not to teach, but to preach. We hypothesize that Christian priests affected education through unofficial channels. Night study gatherings may have played a crucial role in the improvement of literacy because these groups, while not officially recognized as educational institutions, were widespread on the Korean peninsula.

Third, female literacy rates were higher in areas with a larger share of Protestant priests relative to Catholics priests, in 1930. This result corresponds to similar findings in a large set of countries in 1970, and in historic Prussia (Becker and Woessmann, 2008). Also in colonial Korea, Protestantism is known to have played an active role in female education. In particular, Strawn (2013) explains that the Korean Protestant Church operated Bible training schools, which emphasized the reading of the bible, but also helped to improve the literacy rate of women. In the words of Strawn (p.100): "[…] *Bible Women emphasized the reading of the Bible text. This emphasis in turn led to the paramount importance of the need to teach reading to the many illiterate women that Bible Women encountered*." Therefore, our finding is relevant to this historical context.

However, as we mentioned in the introduction, our study does not guarantee a causal link between Christianity and literacy because of the possibility that more educated people are likely to study or accept western knowledge and culture, and in the process will become Christians.

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Appendix

The following appendix table A.1 displays results not only for our main outcome measure, the literacy rate in Korean (either Korean only or Korean and Japanese), but also for Japanese (either Japanese only or Korean and Japanese), as well as literacy in Japanese only or in Korean only. Columns 1 and 3 in this table reproduce 1:1 the columns 1 and 2 in Table of Hong and Paik (2018), for comparison, before adding (in columns 2 and 4) our measures of Christian priests (Christianity), Buddhist monks, and Japanese Shin-To priests. Note also that column 4 reproduces 1:1 column 4 of our own Table 2. Throughout, Table A.1 uses the same control variables as the main tables, including province fixed effects, except that we do not use market size as a control because it did not feature in the set of controls in Hong and Paik (2018), but instead was added during the revision of this paper. As we discussed in the main text, location choice of Christian missionaries and their Korean collaborators and successors is beyond the scope of this paper and left for future research. But Figures 1 and 2 suggest a certain degree of regional clustering in location choice, for instance in the urban centres of Seoul and Pyongyang, which we attempt to capture via province fixed effects. The regressions in Table A.1 therefore use variation across counties within provinces in the presence of different clergy and their association with literacy. The results suggest that the presence of Christian priests is associated with higher literacy rates, even within provinces.

[Table A.1] Literacy rates in Japanese and Korea.

Variable	Both + Only Japanese		Both + Only Korean		Only Japanese		Only Korean	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Passer (Civil Exam) per 1k	1.367*	1.378**	1.943*	1.908*	0.433	0.446	1.009	0.975
	(0.718)	(0.660)	(1.115)	(1.089)	(0.289)	(0.281)	(0.739)	(0.746)
Priests (Christianity) per 1k		14.950**		15.394***		3.030		3.474
		(5.885)		(5.141)		(2.240)		(2.259)
Monks (Buddhism) per 1k		0.319		0.270		-0.022		-0.071
		(0.310)		(0.408)		(0.133)		(0.275)
Japanese Shin-To Priests per 1k		0.199		-2.445*		0.774		-1.869***
		(2.785)		(1.323)		(1.461)		(0.655)
Yangban (upper social class) share (1909)	19.044	16.524	17.165	14.966	10.325	9.582	8.446	8.024
	(17.023)	(13.055)	(11.838)	(12.647)	(8.204)	(7.219)	(11.301)	(11.916)
Non Agricultural Occupation(%)	0.640**	0.487**	0.380***	0.240***	0.259**	0.225**	-0.001	-0.021
	(0.248)	(0.204)	(0.135)	(0.092)	(0.120)	(0.109)	(0.088)	(0.087)
Population density (1,000 people/km^2)	0.627	0.308	0.495	0.124	0.158	0.113	0.026	-0.072
	(0.405)	(0.380)	(0.462)	(0.451)	(0.246)	(0.239)	(0.277)	(0.271)
Distance to Seoul (km)	0.006	0.010**	-0.005	-0.001	0.003	0.003	-0.008***	-0.008**
	(0.005)	(0.004)	(0.005)	(0.005)	(0.002)	(0.002)	(0.003)	(0.003)
Land tenancy ratio	0.610**	0.496*	0.775**	0.742**	0.307***	0.260**	0.473*	0.506*
	(0.264)	(0.252)	(0.355)	(0.371)	(0.105)	(0.102)	(0.260)	(0.271)
Soil acidity	-0.228	0.021	-3.684*	-3.383*	1.157	1.133	-2.299*	-2.271*
	(1.926)	(1.625)	(2.035)	(1.875)	(0.887)	(0.846)	(1.357)	(1.364)
Soil acidity, squared	-0.097	-0.080	0.438	0.443	-0.237	-0.222	0.297	0.302
	(0.333)	(0.280)	(0.335)	(0.307)	(0.158)	(0.152)	(0.218)	(0.218)
Soil acidity variation	-0.329	-0.381	0.477	0.437	-0.104	-0.119	0.702**	0.700**
	(0.523)	(0.424)	(0.513)	(0.446)	(0.240)	(0.226)	(0.344)	(0.345)
Province Fixed Effect	YES	YES	YES	YES	YES	YES	YES	YES
Observations	201	201	201	201	201	201	201	201
R-squared	0.594	0.675	0.674	0.726	0.478	0.505	0.703	0.711
Mean of dependent variable	6.988	6.988	21.28	21.28	0.889	0.889	15.18	15.18

Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1

[Table A.2] Literacy Rate and the Number of Believers of Different Faiths at the Province level.

	(1)	(2)	(3)	(4)	(5)	(6)
Share of Christians [Province] [1932]	2.428***	1.877***	1.569***	1.955**	1.553	1.060
	(0.363)	(0.269)	(0.336)	(0.686)	(1.147)	(1.002)
Share of Buddhists [Province] [1932]		-4.172***	-4.793***	-12.177***	-4.234***	37.387
		(0.619)	(0.581)	(3.010)	(0.587)	(27.157)
Share of Believers of Shin-To [Province] [1932]		1.893***	1.188**	8.782	0.075	-34.185
		(0.250)	(0.510)	(7.886)	(0.714)	(20.570)
Passer (Civil Exam) per 1k			2.410***	2.287***	2.463***	2.287***
			(0.730)	(0.748)	(0.688)	(0.748)
Public Schools per 1k [Province]					7.569	-419.207
					(61.519)	(256.414)
Private Schools per 1k [Province]					77.876**	15.062
					(27.767)	(47.183)
Missionary Schools in per 1k [Province]					-9.462	203.644***
					(91.480)	(46.692)
Control Variables	NO	NO	YES	YES	YES	YES
Province Fixed Effect	NO	NO	NO	YES	NO	YES
Observations	234 (13)	234 (13)	199(13)	199(13)	199 (13)	199 (13)
R-squared	0.252	0.391	0.587	0.687	0.624	0.687
Mean of dependent variable	21.92	21.92	21.10	21.10	21.10	21.10

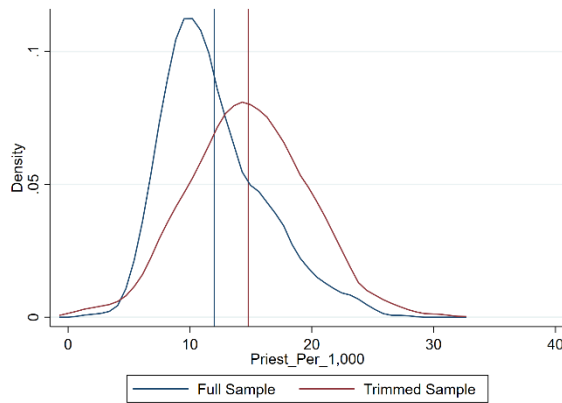Robust standard errors (columns 1-4) and standard errors clustered by province (columns 4-6) in parentheses:
*** p<0.01, ** p<0.05, * p<0.1, values in parentheses of Observations means the number of Provinces.
Control variables are the *Yangban* (upper social class) share in 1909, Non-Agricultural Occupation (%), Population density (1,000 people/km^2), Distance to Seoul (km), mean of Soil acidity and its square, and variance of Soil acidity, which are identical to the controls used by Hong and Paik (2018). Market size per capita is included as a control variable which was used by Park (2020).
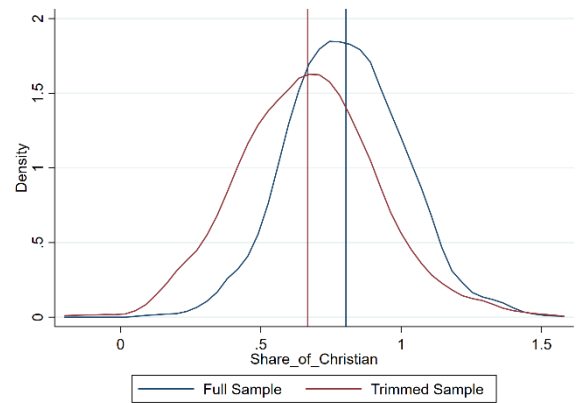
The following appendix [Figure B.1] and [Figure B.2] shows the results from bootstrap estimations in our main finding without extreme value. Figure B.1 and B.2 are kernel density plots of coefficients when we perform 1,000 replications. The kernel density in blue color ("Full sample") means that we used all observation in our sample, while red colour ("Trimmed sample") means that we eliminated the top 5% and bottom 5% of observation in the number of priests and the share of Christians, respectively. As mentioned above, the last column of Table 2 and 3 includes all control variables.

According to the [Figure B.1] and [Figure B.2], the distributions of coefficients are quite similar regardless of extreme observations. Furthermore, the interval of coefficients does not include zero value. Therefore, we can argue that our main finding is robust and significant.

[Figure B.1] Bootstrap Estimation of   [Figure B.2] Bootstrap Estimation of

Last Column in Table 2   Last Column in Table 3

Note: Kernel density plots of coefficients based on bootstrap sampling with 1,000 iterations. Blue curves use the full estimation sample as a starting point for the bootstrap procedure. Red curves use a trimmed sample (removing top 5% and bottom 5% of the distribution of the regressor of interest) as a starting point for the bootstrap procedure. Vertical lines mean the average of coefficients in independent variables. (Priest per 1,000 & Share of Christian) Figure B.1 displays bootstrapped coefficient estimates for the variable "Priest (Christianity) per 1k" using the specification in Table 2, column 6. Figure B.2 displays bootstrapped coefficient estimates for the variable "Share of Christians" using the specification in Table 3, column 6.